

WHAT IS CLAIMED IS:

1. A transmitted type diffractive optical element comprising a transparent plate formed with a diffraction grating, the transparent plate having first and second surfaces parallel to each other;

the first surface being in contact with a medium and formed with the diffraction grating, the second surface being provided with an antireflection film;

wherein, when light is incident on the first surface of the transparent plate from the medium, there are a wavelength  $\lambda$  and an incident angle  $\theta$  of the light satisfying the correlation expressions of  $(2n_1L/\lambda)\sin\theta=1$  and  $n_2/n_1 \leq 3\sin\theta$ , where  $n_1$  is the refractive index of the medium,  $n_2$  is the refractive index in the first surface of the transparent plate ( $n_1 < n_2$ ), and  $L$  is the period of the diffraction grating; and

wherein, at the wavelength  $\lambda$  and incident angle  $\theta$ , transmitted first-order diffracted light in a TE polarization mode has a diffraction efficiency  $\eta_{TE}$  of at least 0.8, and transmitted first-order diffracted light in a TM polarization mode has a diffraction efficiency  $\eta_{TM}$  of at least 0.8.

2. A transmitted type diffractive optical element according to claim 1, wherein the wavelength  $\lambda$  falls within a predetermined wavelength band, each of the diffraction efficiencies  $\eta_{TE}$  and  $\eta_{TM}$  being at least 0.8 in the whole

predetermined wavelength band.

3. A transmitted type diffractive optical element according to claim 1, wherein each of the diffraction efficiencies  $\eta_{TE}$  and  $\eta_{TM}$  is at least 0.85 at the wavelength  $\lambda$  and the incident angle  $\theta$ .

4. A transmitted type diffractive optical element according to claim 3, wherein the wavelength  $\lambda$  falls within a predetermined wavelength band, each of the diffraction efficiencies  $\eta_{TE}$  and  $\eta_{TM}$  being at least 0.85 in the whole predetermined wavelength band.

5. A transmitted type diffractive optical element according to claim 1, wherein each of the diffraction efficiencies  $\eta_{TE}$  and  $\eta_{TM}$  is at least 0.9 at the wavelength  $\lambda$  and the incident angle  $\theta$ .

6. A transmitted type diffractive optical element according to claim 5, wherein the wavelength  $\lambda$  falls within a predetermined wavelength band, each of the diffraction efficiencies  $\eta_{TE}$  and  $\eta_{TM}$  being at least 0.9 in the whole predetermined wavelength band.

7. A transmitted type diffractive optical element according to claim 1, wherein the diffraction efficiencies  $\eta_{TE}$  and  $\eta_{TM}$  have a difference of 0.05 or less therebetween at the wavelength  $\lambda$  and the incident angle  $\theta$ .

8. A transmitted type diffractive optical element according to claim 7, wherein the wavelength  $\lambda$  falls within a predetermined wavelength band, maximum and minimum values

of the diffraction efficiencies  $\eta_{TE}$  and  $\eta_{TM}$  having a difference of 0.05 or less therebetween in the whole predetermined wavelength band.

5           9.     A transmitted type diffractive optical element according to claim 1, wherein the diffraction efficiencies  $\eta_{TE}$  and  $\eta_{TM}$  have a difference of 0.025 or less therebetween at the wavelength  $\lambda$  and the incident angle  $\theta$ .

10           10.    A transmitted type diffractive optical element according to claim 9, wherein the wavelength  $\lambda$  falls within a predetermined wavelength band, maximum and minimum values of the diffraction efficiencies  $\eta_{TE}$  and  $\eta_{TM}$  having a difference of 0.025 or less therebetween in the whole predetermined wavelength band.

15           11.    A transmitted type diffractive optical element according to one of claims 2, 4, 6, 8, and 10, wherein the predetermined wavelength band includes C band.

          12.    A transmitted type diffractive optical element according to one of claims 2, 4, 6, 8, and 10, wherein the predetermined wavelength band includes L band.

20           13.    A transmitted type diffractive optical element according to one of claims 2, 4, 6, 8, and 10, wherein the predetermined wavelength band includes both C and L bands.

          14.    A transmitted type diffractive optical element according to claim 1, wherein the period  $L$  of the diffraction grating is 2.5  $\mu\text{m}$  or less.

          15.    A transmitted type diffractive optical element

according to claim 1, wherein the wavelength  $\lambda$  falls within a wavelength band of 1.26  $\mu\text{m}$  to 1.675  $\mu\text{m}$ .